CHI MEI OPTOELECTRONICS CORP.

Issued Date: Feb. 21, 2006
Model No.: N154I1-L0D
Approval

TFT LCD Approval Specification

MODEL NO.: N154I1-L0D

Customer : _____

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval
陳 95. 2. 24 永一	林 95. 2. 22 添仁

Version 2.1

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 0.0	Oct.18,'05	All	All	Tentative specification first issued.
Ver 2.0	Feb.14,'06	6	2.2.2	Backlight Unit
		7	3.1	TFT LCD Module – Power Supply Current
		8	3.2	Backlight Unit
		11	5.2	Backlight Unit – H.V. cable color
		15	5.5	EDID Data Structure
		17	6.1	Input signal timing specification
		20	7.2	Optical Specifications
		23	9.1	Carton drawing
		24	9.2	Pallet drawing
		26	10.2	Carton Label
Ver 2.1	Feb.21,'06	11	4.1	TFT LCD Module – EDID/EEPROM Block
		23	7.2	Note (6), (7)
		27	10.1	CMO Module Label

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N154I1 -L0D is a 15.4" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1280 x 800 Wide-XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight
- WXGA (1280 x 800 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- DE only mode
- Meet RoHS requirement

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	331.2 (H) x 207.0 (V) (15.4" diagonal)	mm	(1)
Bezel Opening Area	335.0 (H) x 210.7 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.2588 (H) x 0.2588 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (2H), AG Type, Nitto Denko "AGS1"	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	343.5	344.0	344.5	mm	(1)
	Vertical(V)	221.5	222.0	222.5	mm	
	Depth(D)	-	6.2	6.5	mm	
Weight		-	600	620	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

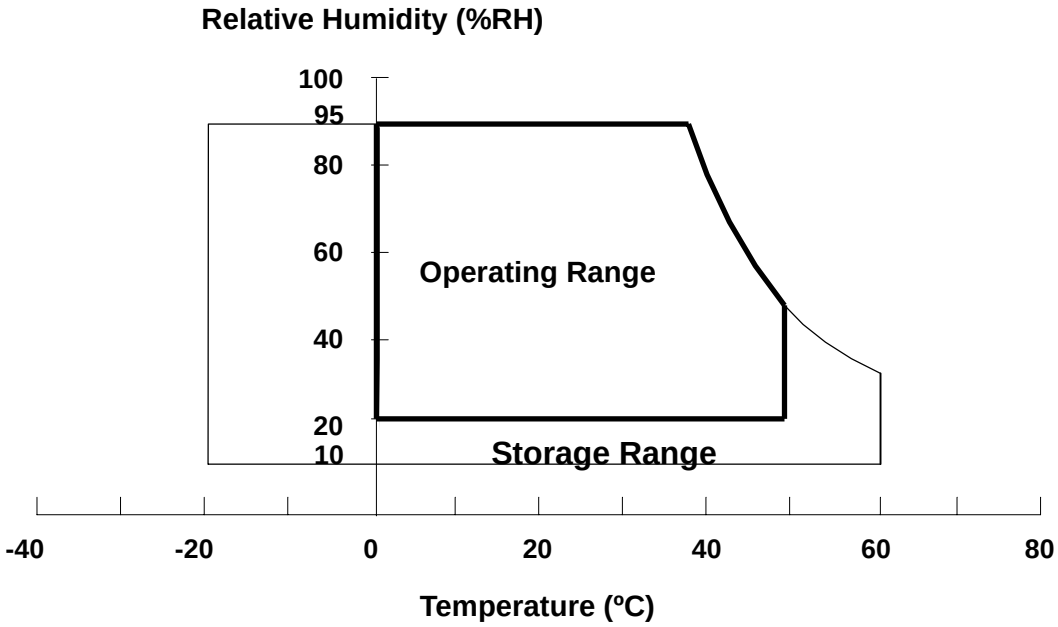
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	C°	(1)
Operating Ambient Temperature	T_{OP}	0	+50	C°	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	210	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 95 %RH Max. (Ta ≦ 40 C°) .

(b) Wet-bulb temperature should be 39 C° Max. (Ta > 40 C°).

(c) No condensation.

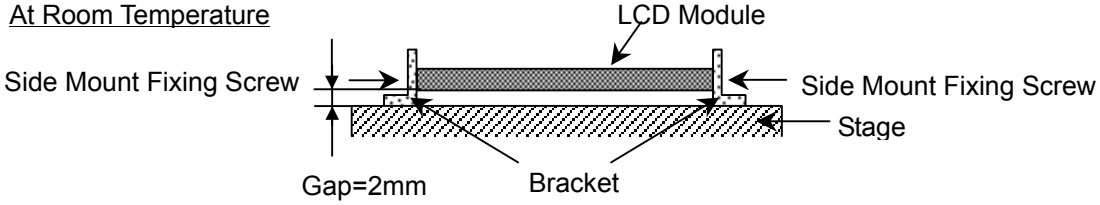


Note (2) The temperature of panel surface should be 0 deg C Min. and 50 deg C Max.

Note (3) 3ms, half sine wave, 1 time for +/- X, +/- Y, +/- Z.

Note (4) 10 ~ 200 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z. The fixing condition is shown as below:

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	Vcc+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = 6.0 mA
Lamp Current	I_L	2	6.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	40	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

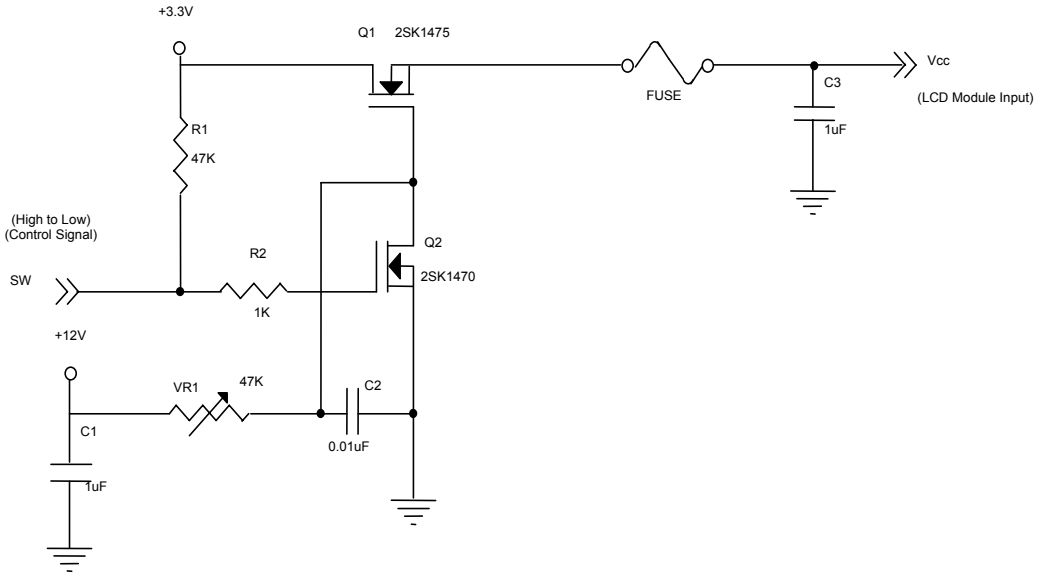
3.1 TFT LCD MODULE

Ta = 25 +/- 2 deg C

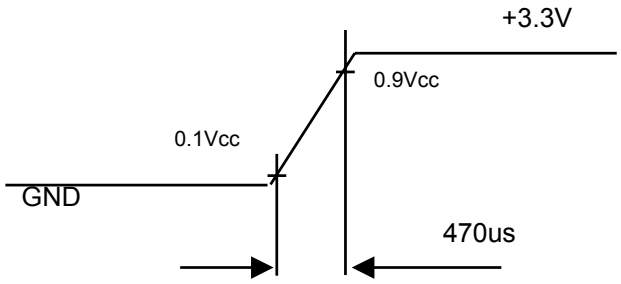
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	50	-	mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Power Supply Current	Pink	Icc	-	300	350	mA	
	Black		--	350	400	mA	
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-	-	+100	mV	-
	"L" Level	V_{IL}	-100	-	-	mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

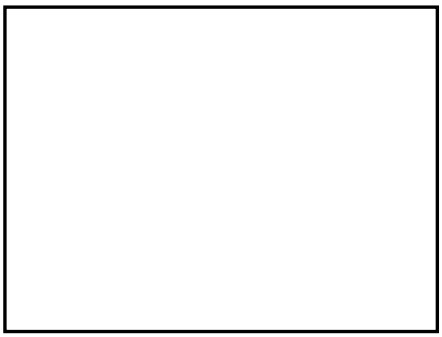


Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

b. Black Pattern



Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.

(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

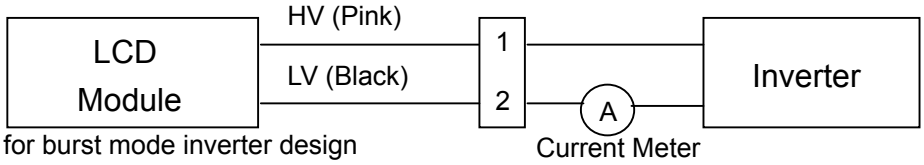
(c) Luminance: 60 nits.

(d) The inverter used is provided from O2Micro (www.o2micro.com). Please contact O2Mirco for detail information. CMO doesn't provide the inverter in this product.

3.2 BACKLIGHT UNIT Ta = 25 +/- 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	585	650	715	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	2.0	6.0	6.5	mA_{RMS}	(1),(2)
		3.0				(1),(3)
Lamp Turn On Voltage	V_S	-	-	1230, 25 ºC	V_{RMS}	(4)
		-	-	1400, 0 ºC	V_{RMS}	(4)
Operating Frequency	F_L	40	-	80	KHz	(5)
Lamp Life Time	L_{BL}	12,000	-	-	Hrs	(7)
Power Consumption	P_L	-	3.9	-	W	(6), I_L = 6.0 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) for burst mode inverter design

Note (3) for continuous mode inverter design

Note (4) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup.

Note (5) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (6) $P_L = I_L \times V_L$

Note (7) The lifetime of lamp is defined as the time when it continues to operate under the conditions at Ta = 25 +/-2 ºC and I_L = 6.0 mA_{RMS} until one of the following events occurs:

(a) When the brightness becomes <= 50% of its original value.

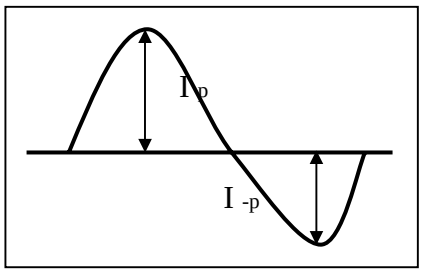
(b) When the effective ignition length becomes <= 80% of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;
b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;
c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

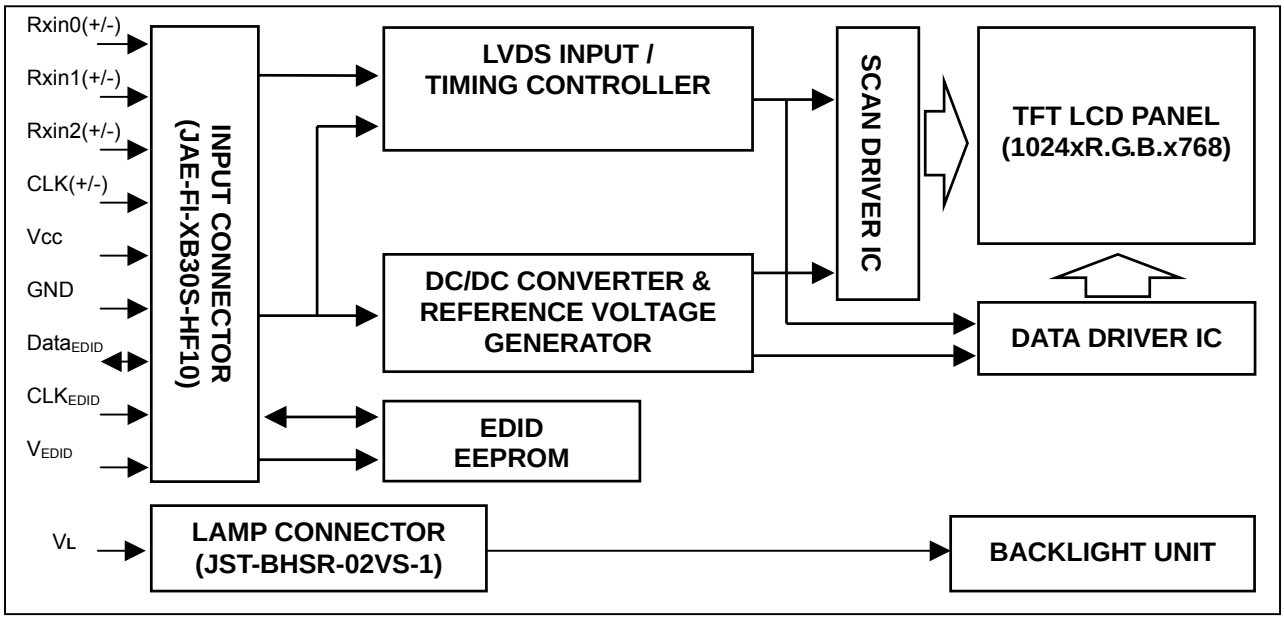
$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

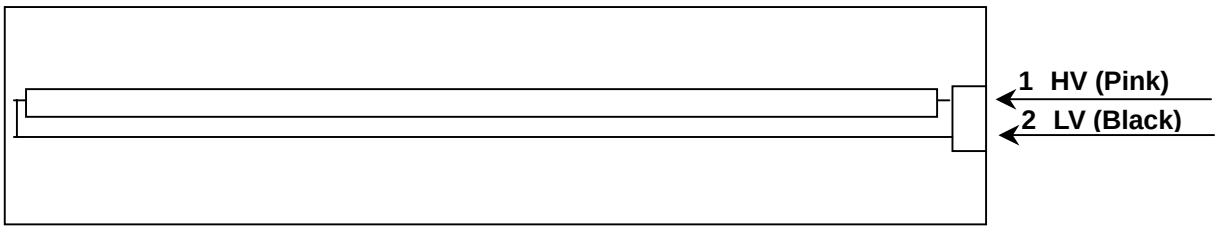
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V (typical)		-
3	Vcc	Power Supply +3.3 V (typical)		-
4	V_{EDID}	DDC 3.3V Power		-
5	NC	Non-Connection	-	-
6	CLK_{EDID}	DDC Clock		-
7	$DATA_{EDID}$	DDC Data		-
8	Rxin0-	LVDS Differential Data Input	Negative	-
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		-
11	Rxin1-	LVDS Differential Data Input	Negative	-
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		-
14	Rxin2-	LVDS Differential Data Input	Negative	-
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		-
17	CLK-	LVDS Clock Data Input	Negative	-
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		-
20	NC	Non-Connection	-	-
21	NC	Non-Connection	-	-
22	Vss	Ground	-	-
23	NC	Non-Connection	-	-
24	NC	Non-Connection	-	-
25	Vss	Ground	-	-
26	NC	Non-Connection	-	-
27	NC	Non-Connection	-	-
28	Vss	Ground	-	-
29	NC	Non-Connection	-	-
30	NC	Non-Connection	-	-

Note (1) Connector Part No.: JAE-FI-XB30SL-HF10

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent

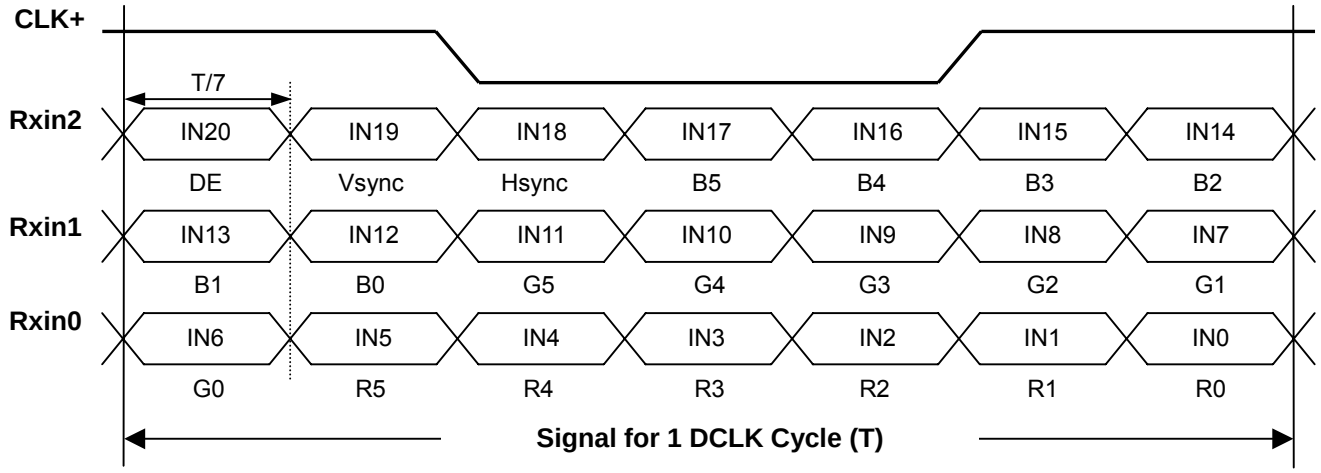
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Basic	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Colors	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Red	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Gray	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Green	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gray	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Blue	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

Byte (decimal)	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header , Fixed	00	00000000
1	1	Header , Fixed	FF	11111111
2	2	Header , Fixed	FF	11111111
3	3	Header , Fixed	FF	11111111
4	4	Header , Fixed	FF	11111111
5	5	Header , Fixed	FF	11111111
6	6	Header , Fixed	FF	11111111
7	7	Header , Fixed	00	00000000
8	8	ID=LEV	30	00110000
9	9	ID=LEV	AE	10101110
10	0A	XGA (IBM Unique ID)	50	01010000
11	0B	XGA (IBM Unique ID)	40	01000000
12	0C	32-bit serial # Unused(01h for VESA, 00h for SPWG)	00	00000000
13	0D	32-bit serial # Unused(01h for VESA, 00h for SPWG)	00	00000000
14	0E	32-bit serial # Unused(01h for VESA, 00h for SPWG)	00	00000000
15	0F	32-bit serial # Unused(01h for VESA, 00h for SPWG)	00	00000000
16	10	Week of manufacture 1 - 53 (unused: 00h) : 02h fixed by CMO	00	00000000
17	11	Year of manufacture year - 1990(unsed:00h) : 0Fh (Year 2005) fixed by CMO	0F	00001111
18	12	Version=1	01	00000001
19	13	Revision=3	03	00000011
20	14	Digital	80	10000000
21	15	Active area horizontal 33.12cm	21	00100001
22	16	Active area vertical 20.70cm	15	00010101
23	17	gamma * 100-100 = 2.2*100-100=120	78	01111000
24	18	Feature support (no DPMS, Active off, RGB, Preferred Timing Mode)	EA	11101010
25	19	Rx1 Rx0 Ry1 Ry0 Gx1 Gx0 Gy1 Gy0	1C	00011100
26	1A	Bx1 Bx0 By1 By0 Wx1 Wx0 Wy1 Wy0	A5	10100101
27	1B	Rx=0.598	99	10011001
28	1C	Ry=0.337	56	01010110
29	1D	Gx=0.323	52	01010010
30	1E	Gy=0.523	86	10000110
31	1F	Bx=0.15	26	00100110
32	20	By=0.127	20	00100000
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established timings 1	21	00100001
36	24	Established timings 2	08	00001000
37	25	No manufacturer's specific timing	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001
42	2A	Standard timing ID # 3	01	00000001

43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Pixel Clock/10,000 (LSB)	C7	11000111
55	37	Pixel Clock/10,000 (MSB) /	1B	00011011
56	38	Horizontal Active	00	00000000
57	39	Horizontal Blanking	A0	10100000
58	3A	Horizontal Active : Horizontal Blanking	50	01010000
59	3B	Vertical Avtive	20	00100000
60	3C	Vertical Blanking	17	00010111
61	3D	Vertical Active : Vertical Blanking	30	00110000
62	3E	Horizontal Sync. Offset	30	00110000
63	3F	Horizontal Sync Pulse Width	20	00100000
64	40	Vertical Sync Offset : Sync Width	36	00110110
65	41	Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
66	42	Horizontal Image Size = 331.2 mm	4B	01001011
67	43	Vertical Image Size = 207.0mm	CF	11001111
68	44	Horizontal & Vertical Image Size	10	00010000
69	45	Horizontal Border = 0	00	00000000
70	46	Vertical Border = 0	00	00000000
71	47	Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives	1C	00011100
72	48	Pixel Clock/10,000 (LSB) 50Hz	26	00100110
73	49	Pixel Clock/10,000 (MSB) / 50Hz	17	00010111
74	4A	Horizontal Active	00	00000000
75	4B	Horizontal Blanking	A0	10100000
76	4C	Horizontal Active : Horizontal Blanking	50	01010000
77	4D	Vertical Active	20	00100000
78	4E	Vertical Blanking	17	00010111
79	4F	Vertical Active : Vertical Blanking	30	00110000
80	50	Horizontal Sync. Offset	30	00110000
81	51	Horizontal Sync Pulse Width	20	00100000
82	52	Vertical Sync Offset : Sync Width	36	00110110
83	53	Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
84	54	Horizontal Image Size = 331.2 mm	4B	01001011
85	55	Vertical Image Size = 207.0mm	CF	11001111
86	56	Horizontal & Vertical Image Size	10	00010000
87	57	Horizontal Border = 0	00	00000000
88	58	Vertical Border = 0	00	00000000
89	59	Non-interlaced, Normal display, no stereo, Digital separate sync, H/V pol negatives	18	00011000
90	5A	Flag	00	00000000
91	5B	Flag	00	00000000

92	5C	Flag	00	00000000
93	5D	Data type tag :0F	0F	00001111
94	5E	Flag	00	00000000
95	5F	Low Refresh Rate #1 (Horizontal active pixels / 8) - 31=129(81h)	81	10000001
96	60	Low Refresh Rate #1 Image Aspect ratio(16 : 10)	0A	00001010
97	61	Low Refresh Rate #1 Refresh Rate=50Hz	32	00110010
98	62	Low Refresh Rate #2 (Horizontal active pixels / 8) - 31=129(81h)	81	10000001
99	63	Low Refresh Rate #2 Image Aspect ratio(16 : 10)	0A	00001010
100	64	Low Refresh Rate #2 Refresh Rate=40Hz	28	00101000
101	65	Brightness (1/10nit) , 150/10=15(=0Fh)	0F	00001111
102	66	Feature Flags	01	00000001
103	67	Reserved	00	00000000
104	68	EISA manufacturer code(3 Character ID) -CMO	0D	00001101
105	69	Compressed ASCII	AF	10101111
106	6A	Panel Supplier Reserved - Product code -2115	15	00010101
107	6B	(Hex, LSB first)	21	00100001
108	6C	Flag	15	00010101
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data type tag : FEh	FE	11111110
112	70	Flag	00	00000000
113	71	"N"	4E	01001110
114	72	"1"	31	00110001
115	73	"5"	35	00110101
116	74	"4"	34	00110100
117	75	"I"	49	01001001
118	76	"1"	31	00110001
119	77	"-"	2D	00101101
120	78	"L"	4C	01001100
121	79	"0"	30	00110000
122	7A	"D"	44	01000100
123	7B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	No extension	00	00000000
127	7F	One-byte checksum of entire 128 bytes EDID equals 00h.	34	00110100

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

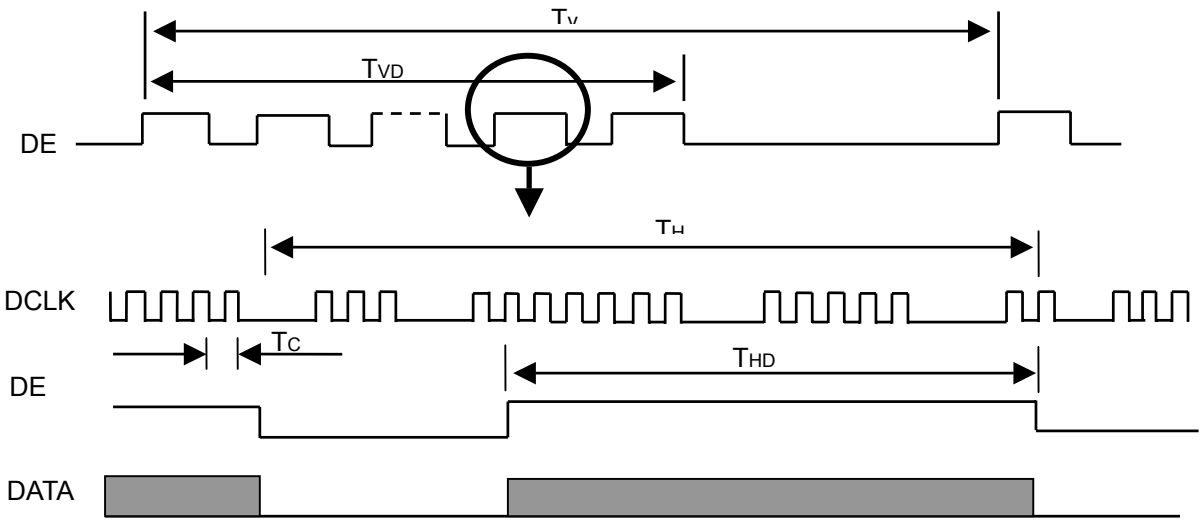
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

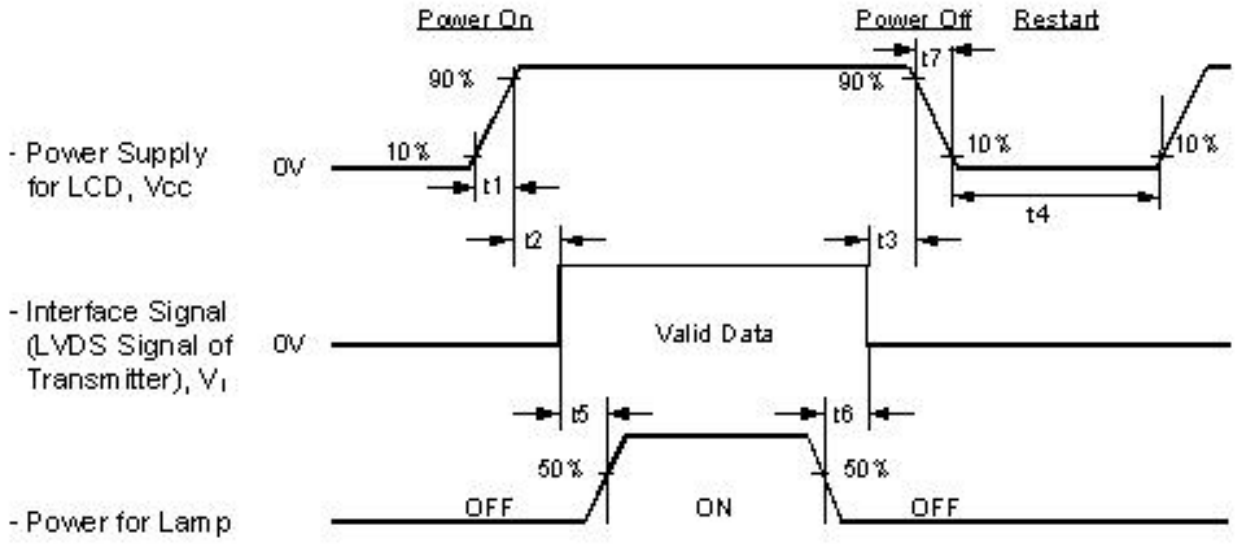
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	-	71.1	80	MHz	-
DE	Vertical Total Time	TV	804	823	1300	TH	-
	Vertical Addressing Time	TVD	800	800	800	TH	-
	Horizontal Total Time	TH	1350	1440	2000	Tc	-
	Horizontal Addressing Time	THD	1280	1280	1280	Tc	-
Frame rate	Frequency	-	40	60	-	Hz	(1)

Note (1) If frame rate is operated at 40Hz, flicker phenomenon may be observed.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

t1 <= 10 msec

0 < t2 <= 50 msec

t3 >= 0 msec

t4 >= 150 msec

t5 >= 200 msec

t6 >= 0 msec

t7 <= 10 msec

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time had better to follow

t7 >= 5 msec

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

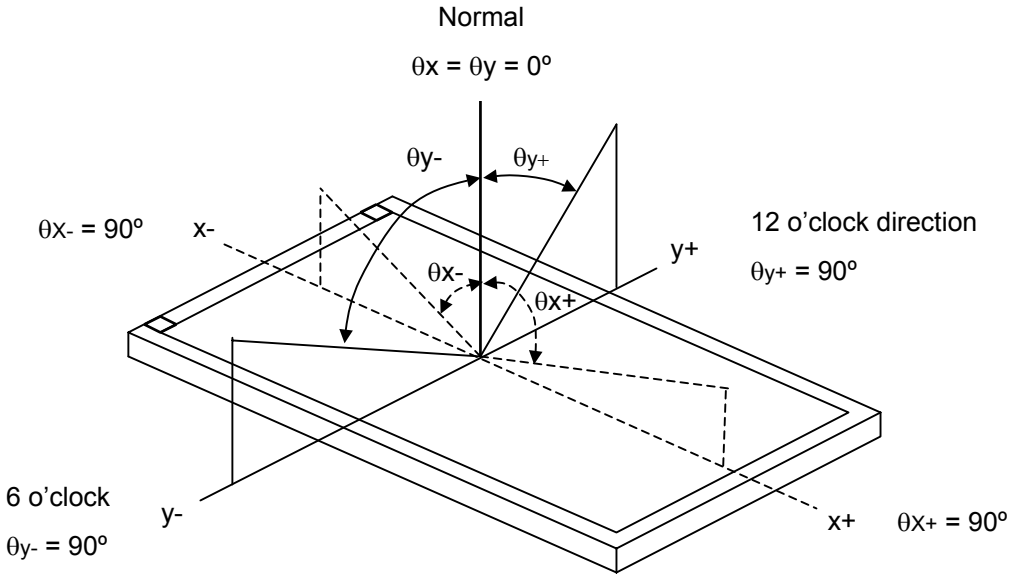
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25+/-2	Deg C
Ambient Humidity	Ha	50+/-10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	55	KHz
Inverter	Sumida-H05-4915		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	280	400		-	(2), (5)
Response Time		T_R		-	5	10	ms	(3)
		T_F		-	11	16	ms	
Luminance of White		L_5		140	150		cd/m^2	(4), (5)
Color Chromaticity	Red	Rx		TYP -0.03	0.597	TYP +0.03	(1), (5)	(1)
		Ry			0.336			
	Green	Gx			0.321			
		Gy			0.523			
	Blue	Bx			0.149			
		By			0.121			
	White	Wx			0.318			
		Wy			0.320			
	Color Gamut	C.G		42	45	-	%	(7)
White Variation of 5 Points		δW_{5p}	θ_x=0°, θ_Y =0° (BM-5A)	80	-	-	%	(5),(6)
White Variation of 13 Points		δW_{13p}		65	-	-	%	
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45		Deg.	(1), (5)
		θ_x-		40	45			
	Vertical	θ_Y+		15	20			
		θ_Y-		40	45			

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

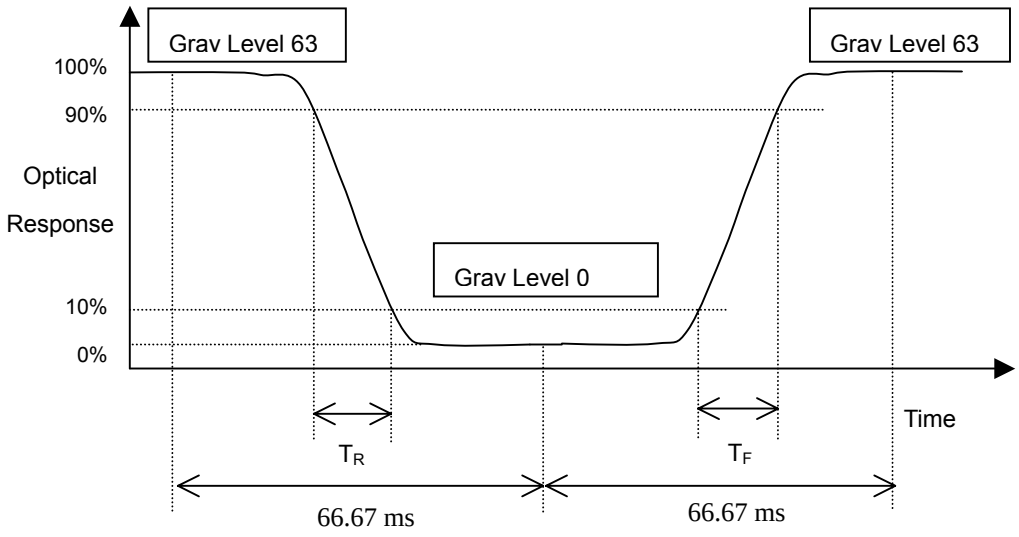
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



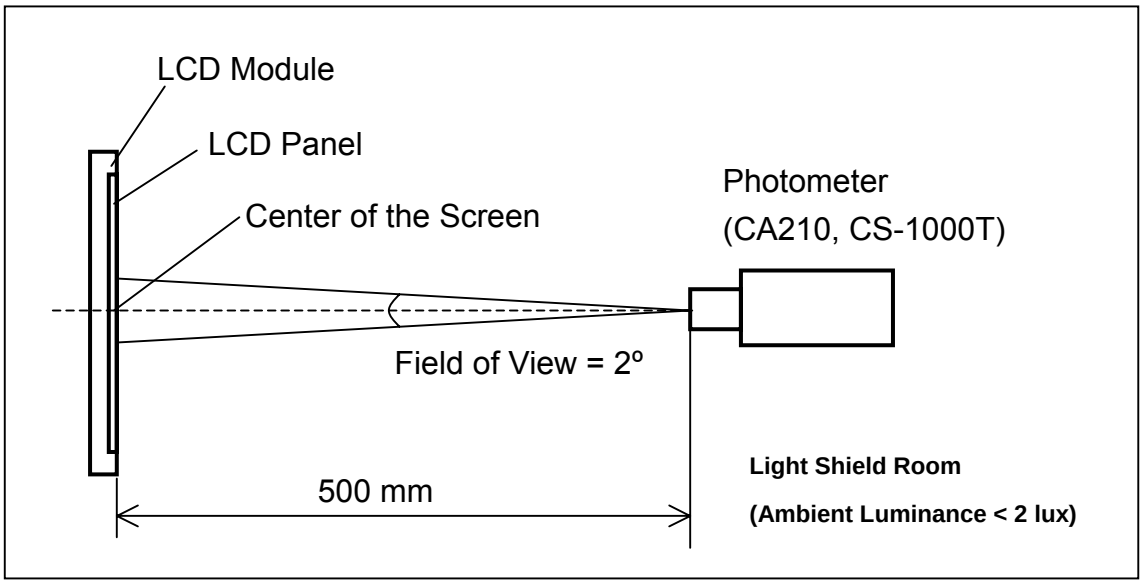
Note (4) Definition of Average Luminance of White (L_5):

Measure the luminance of gray level 63 at 5 points

L (x) is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

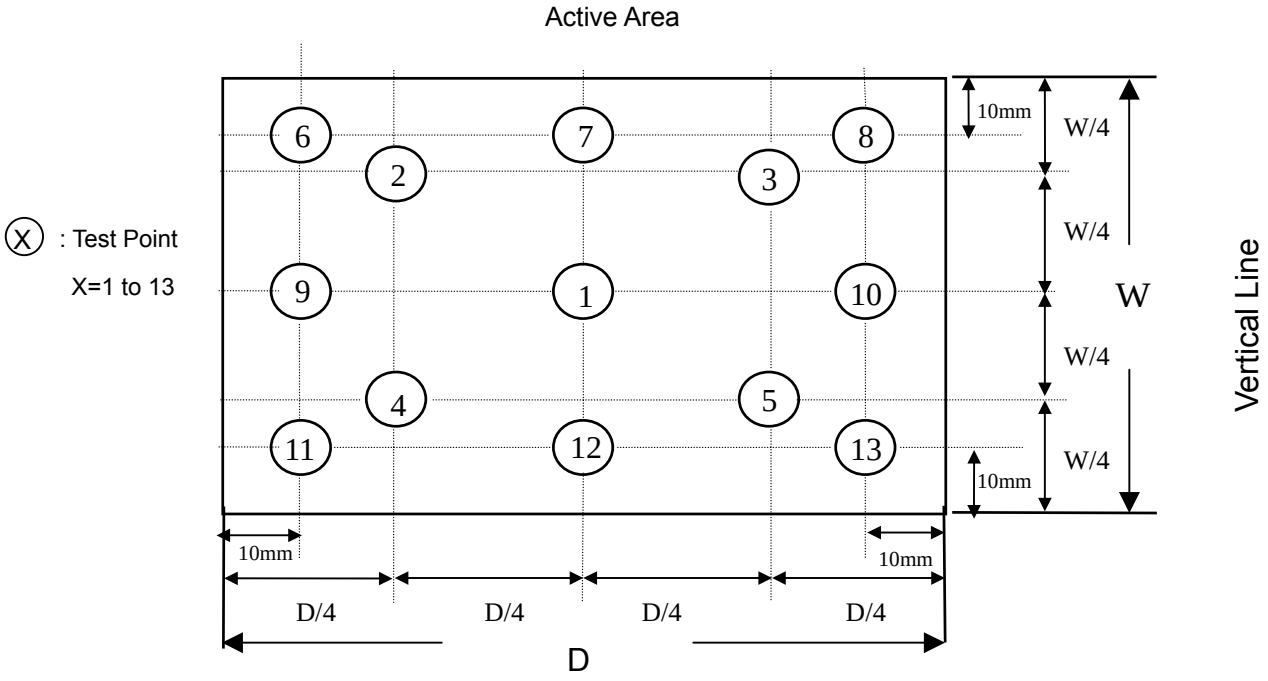


Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW_{5p} = Minimum [L (10)+ L (11)+ L (12)+ L (13)+ L (5)] / Maximum [L (10)+ L (11)+ L (12)+ L (13)+ L (5)]

δW_{13p} = Minimum [L (1) ~ L (13)] / Maximum [L (1) ~ L (13)]



Note (7) Definition of color gamut (C.G%):

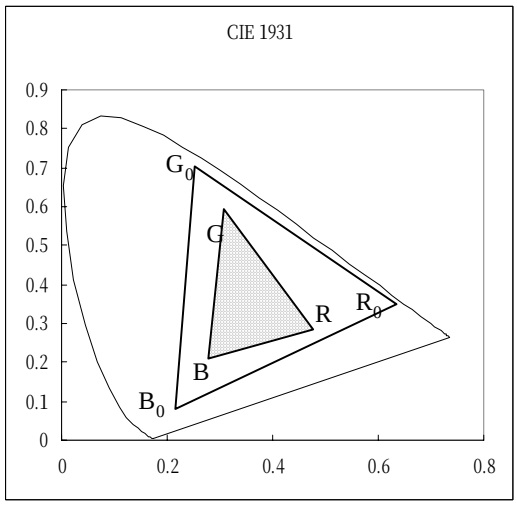
C.G%= R G B / R_0 G_0 B_0,*100%

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

R_0 G_0 B_0 : area of triangle defined by R_0, G_0, B_0

. R G B: area of triangle defined by R, G, B



8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 deg C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

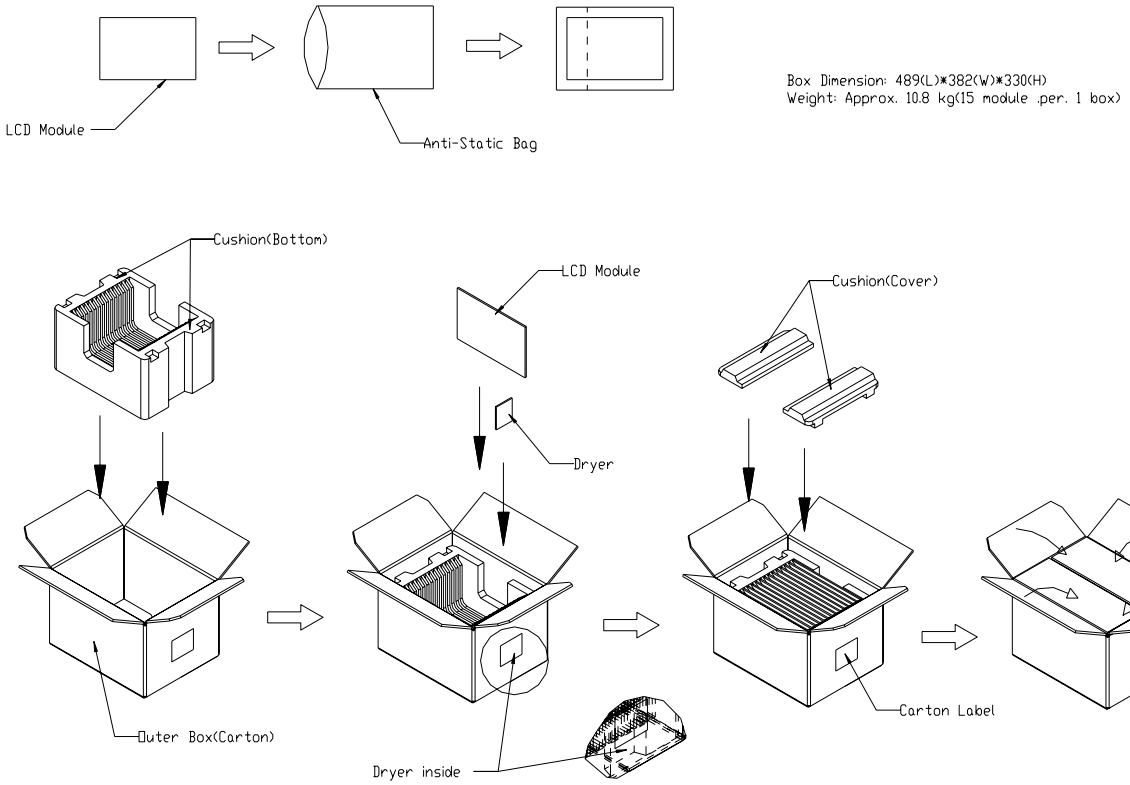
(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

9. PACKING

9.1 CARTON

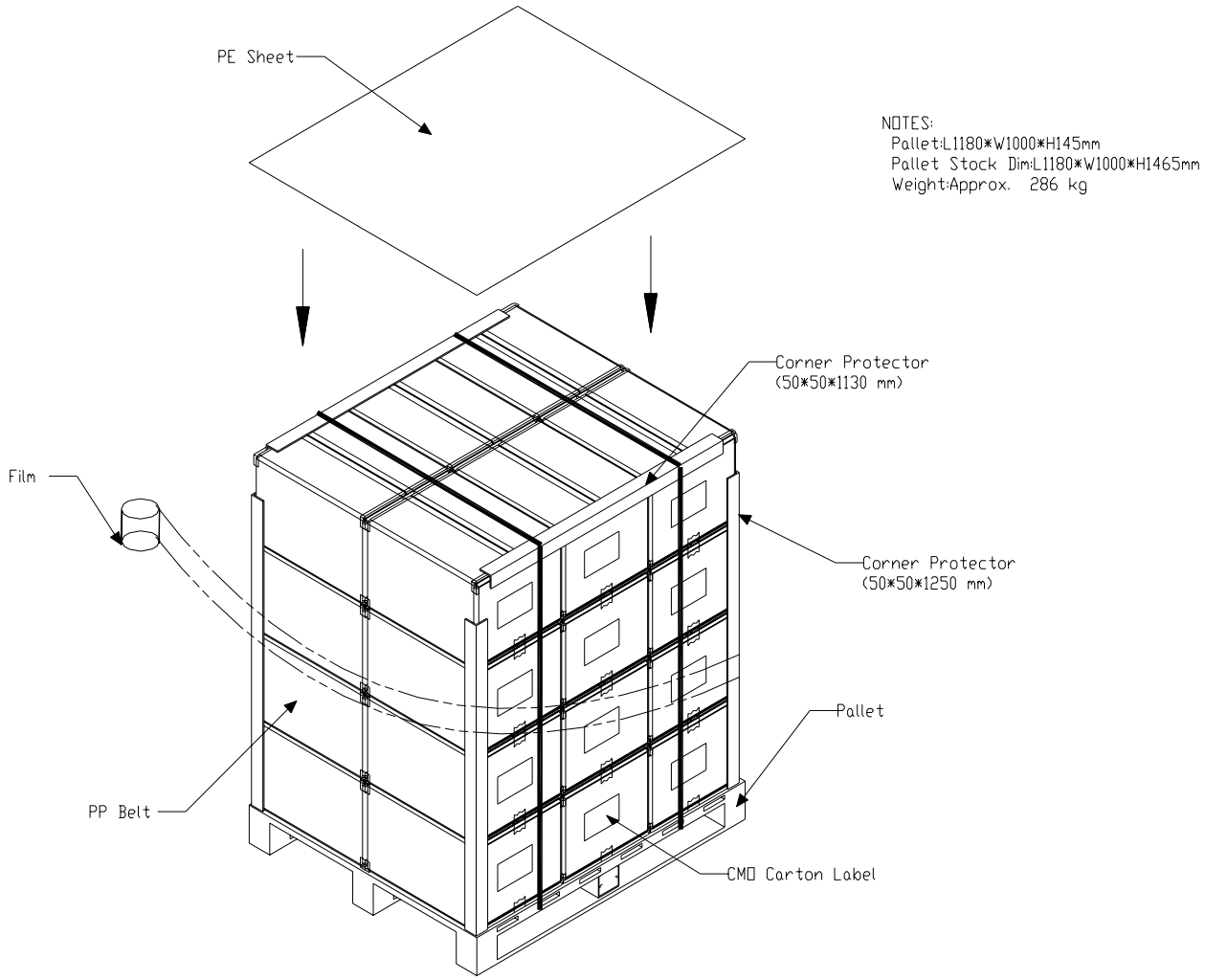


Packing testing criteria :

(1) Packing drop : 1 corner, 3 edges, 6 faces, each direction for one time, follow ISTA standard.

(2) Packing vibration : Random, follow ISTA standard.

9.2 PALLET



10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N154I1 - L0D

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X Y M D L N N N N

- Serial No.
- Product Line
- Year, Month, Date
- CMO Internal Use
- Revision
- CMO Internal Use

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

For Lenovo's barcode content

11S PPPPPPP Z1Z HHH SSSSSS YMM

(a) 11S: Fixed characters.

(b) PPPPPPP (P/N): Customer part number 13N7113, fixed characters

(c) Z1Z: Fixed characters.

(d) HHH (Header Code): B7G

(e) SSSSSS: Series number.

(f) YMM: Y: The last character of year.

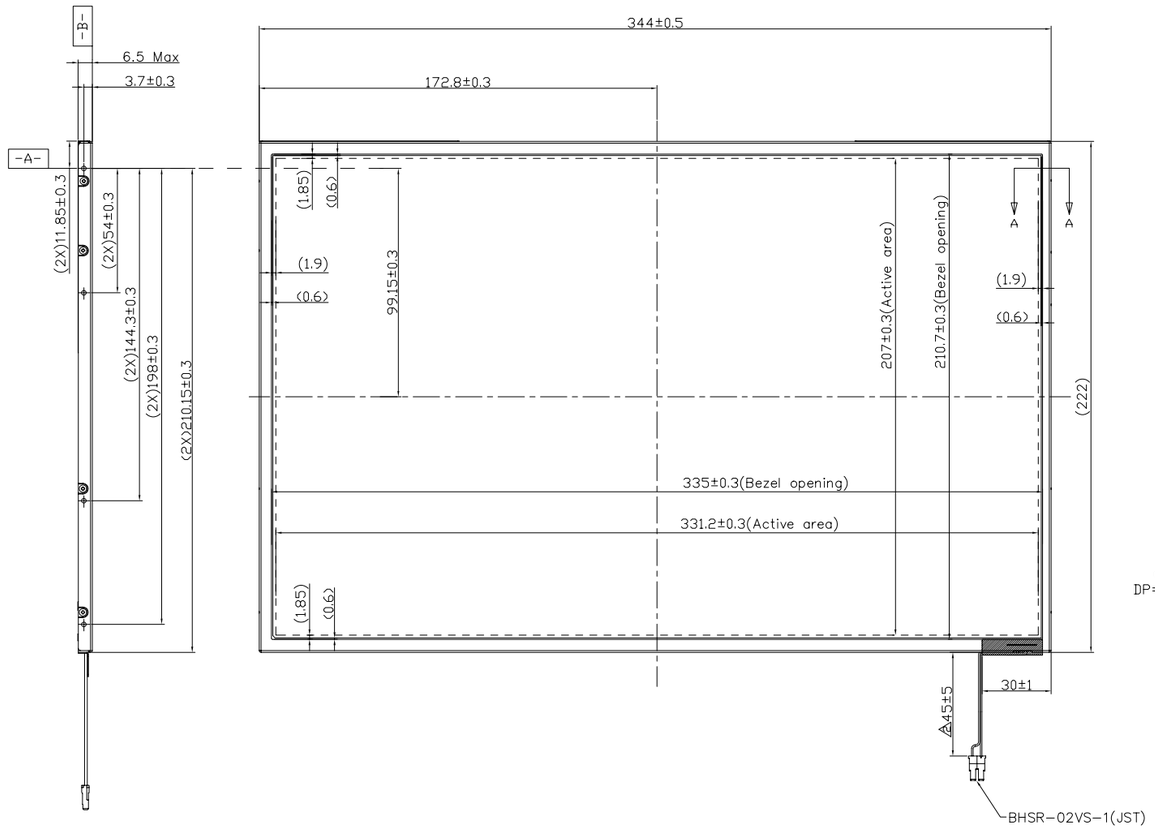
MM: Month

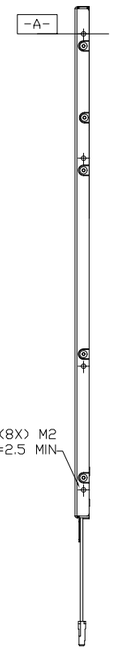
10.2 CARTON LABEL

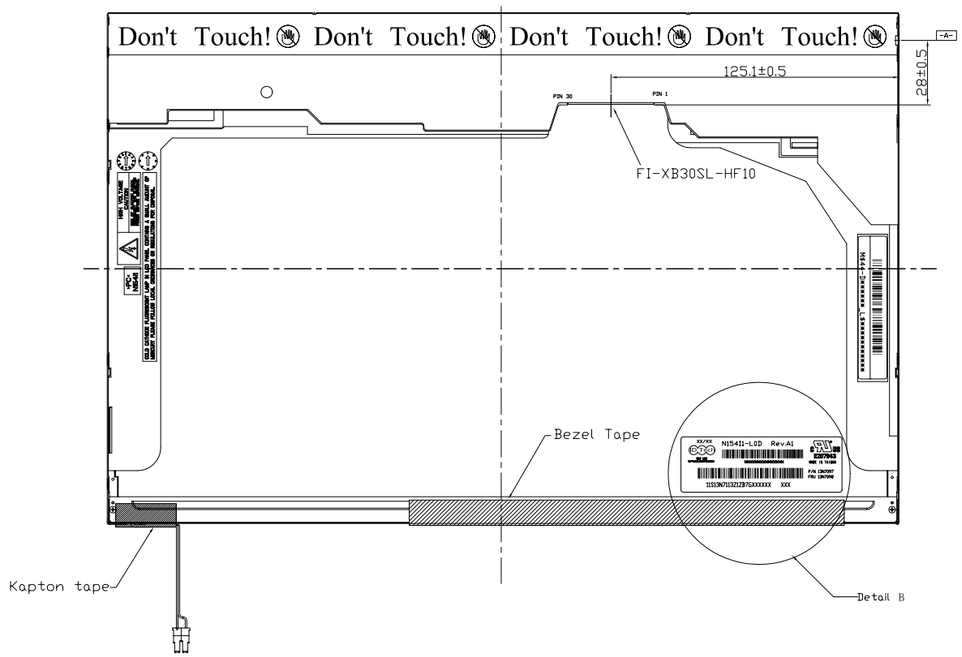
P/N: 13N7017

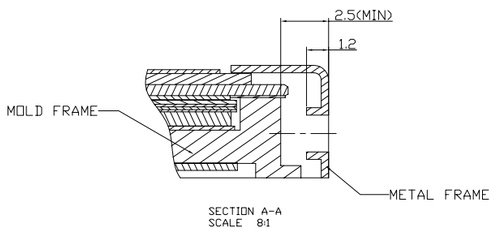
N154I1-L0D

Notes:
1. General Tolerance : ±0.5
2. The screw torque for mounting shall not exceed 2.5kgf-cm.
3. The gap between the panel and the bezel is 0.5mm max.
4. Min. screw hole length : 2.5mm.









SECTION A-A
SCALE 8:1

Detail B
SCALE 2:1

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	Outline Drawing N154I1-L0D					2D REV.	1.0
						3D REV.	
Approved	Bill Sheu	Drawing No.	N154D41011				
Checked	Yule Lin	Part No.					
Drawer	Julie Lien	Material			Sheet	1 / 1	A3
Designer	Julie Lien	Date	30-Sep-2005	Scale	1:1	Unit:mm	

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